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DELTA SIMULATION MODEL 2 USER GROUP NEWSLETTER

SUMMER 2013

► PROJECTS UPDATE

2013 ANNUAL REPORT

Ralph Finch, Senior Engineer WR, DWR

The following are brief summaries of modeling work conducted during 2012, which will be presented in the 2013 Annual Report to the State Water Resources Control Board.

Chapter 1 – Temperature Model Development for CalSim

River water temperature is important for the conservation of fishery habitat. Changes of water delivery or construction around water ways may impact of fish mortality by changing river water temperature. Water temperature is highly relevant to fish mortality and also indirectly influences habitat. Current temperature modeling takes flow output from CalSim and then estimates temperature at points of interest. However, when it violates the downstream temperature requirement, there is no way to adjust outflow or storage to lower the impact.

This chapter documents the work on integrating the Sacramento River Water Quality Model (SRWQM) into CalSim and making reasonably accurate estimates for released water temperature. Through this integration, CalSim can adjust flow or storage to meet river temperature requirements.

continued inside>>>

Chapter 2 – Extension of DSM2 for the South Bay and California Aqueducts and Delta Mendota Canal

This chapter is a summary of the full report that documents work on the DSM2 Aqueduct model: (1) extending the model simulation period from 3 years starting January 1, 2001, to 21 years starting from January 1, 1990; (2) modifying the ways to treat gains and losses of water as a result of seepage, evaporation, rainfall, storm water inflow, meter reading errors, etc.; (3) enhancing the model's capability of calculating water quality by adding two more constituents, dissolved organic carbon (DOC) and Bromide; and (4) incorporating inflows from ground water and storm water.

Chapter 3 – DSM2 Version 8.1 Calibration with NAVD88 Datum

A new calibration has been performed for Version 8.1 of DSM2, which incorporates the latest improvements to the DSM2 code. The main differences in DSM2 version 8.1 include: DSM2-Qual model formulation change to improve model; modifications to the DSM2-Hydro program source code that improve channel geometry calculation; datum conversion to NAVD88; and Martinez EC boundary correction. Since these changes affect results both in DSM2 Hydro and Qual, a new calibration is needed. This chapter documents the calibration effort done by adjusting Manning's coefficient values in Hydro and dispersion coefficients in Qual. Further improvements involving other changes, e.g. new bathymetry and grid change, may come in future releases.

Chapter 4 – Adding Salmon Route Selection Behavior to DSM2 Particle Tracking Model

DSM2 Particle Tracking Model (PTM) simulates the transport and fate of individual neutrally buoyant particles through the Sacramento – San Joaquin Delta. Since its initial development in 1993, the model has been updated. New features, such as attaching fish-like behaviors to particles, have been added to the model. Although the model itself has been calibrated and validated using a field dye study, the adequacy of the model for simulating fish migration has never been quantitatively evaluated due to the lack of field fish monitoring data. Recent developments in the field monitoring, especially in acoustic telemetry fish tag studies, have made it possible for evaluating the adequacy of applying PTM to simulating fish behaviors. This chapter describes the implementation of fish route selection behavior in PTM and the results of the implementation. The approach for using PTM to simulate fish behaviors and the improvements needed for PTM to better simulate fish behaviors are also discussed.

Chapter 5 – Particle Filter for DSM2-PTM

This chapter documents the development of a PTM module feature which simulates directing/blocking particles without affecting flows. One of the major applications of this particle filter is to simulate fish screens and non-physical barriers, which could prevent fish from entering some water area. Another application is to provide an option to keep fish from entering agricultural diversions, seepage to groundwater, and water transfer facilities.



Chapter 6 – DSM2-PTM Improvements

This chapter describes bug fixes and related tests of DSM2-PTM, with a focus on convergence tests for different PTM time steps. Bugs discovered are:

1. Missing advection: in the loop through the sub-time steps within one PTM time step, the last sub-time cycle is usually missed. This can delay particle motion and the error accumulated can be significant.
2. First time-step error: PTM reads hydrodynamics information from tide file; the first time-step has an initial calculation error. This leads to erroneous results, when particles are released at the beginning of PTM simulation start time.
3. Time interpolation factor (θ) inconsistency: two different weighting average factors between the current and the previous time step are inconsistent for flow, depth, cross-section area, and stage.
4. Missing dispersion: when a particle arrives at the end of a channel, the random motion in y and z direction is missed for the last sub-time step. This leads to erroneous results, especially in a grid system with many connected channels such as Delta.
5. Error warning for transfer: an error exists in the function that checks flow balance for nodes connecting transfers and reservoirs. This doesn't affect the calculated value but will slow down the module running when the grid has this kind of waterbody combination.

Chapter 7 – DSM2-PTM Standard Test Suite Design and Automation

The DSM2-PTM Module is undergoing development for new features and bug fixes. It is essential to have its tests standardized and automated for the changes to the code and input data. This chapter describes the PTM standard test suite design, including several DSM2 test grids, their respective key configuration variables, and design purpose. Scenario runs and plots generation can be batch processed for every version of DSM2-PTM. This batch automation is implemented by Python scripts.



DSM2 VERSION 8.1 UPDATE

Lianwu Liu, Engineer WR, DWR & Nicky Sandhu, Senior Engineer WR, DWR

Version 8.1 incorporates latest improvements to DSM2 code. The main updates in this new version include: DSM2-Qual model formulation change to improve model convergence, documented in Chapter 1 of the 2011 Annual Progress Report; modifications to the DSM2-Hydro program source code that improve channel geometry calculation, documented in Chapter 2 of the 2012 Annual Progress Report; datum conversion to NAVD88; an error in Martinez EC boundary was corrected. The new Hydro has also been improved to run much faster than the previous version.

A new calibration effort has been going on as a result of these changes. It was based on the 2009 BDCP calibration grid which has been converted to NAVD88 datum. Some data errors in Clifton Court Gate operation data, Martinez stage and EC data were corrected. The calibration was done by adjusting Manning's coefficient values in Hydro and dispersion coefficients in Qual. The new calibrated model results are generally very close to the 2009 BDCP calibration results, with small improvements at a few locations. The model predicted EC at key stations in Central Delta fairly well (Collinsville, Emmaton, Antioch, Jersey Point).

The preliminary calibration has been presented internally. We are getting feedbacks and working on refining the calibration. Recently we have been testing with BDCP runs, a bug was found and fixed. We look forward to releasing this version by the end of the summer. Further improvements involving other changes, e.g. grid changes or new bathymetry, may come in future releases.

DSM2 LONG TERM CALIBRATION UPDATE

Ralph Finch, Senior Engineer WR, DWR

The last full calibration of DSM2 was conducted under the auspices of IEP in the late 1990s–early 2000s.¹ Since then, there are more observed data available (both timeseries and geometry), stage datums in the Delta have been established, much better estimates of Delta Consumptive Use are available, bug fixes and significant improvements to DSM2 have been made, and we have access to much more computing power to perform more calibration runs. Some “mini-calibrations” of DSM2 have been done, mostly to tweak existing calibration coefficients for changes in the Delta (Liberty Island flooding) or correct for bug fixes and improvements to the DSM2 code.

All calibrations to the Fisher Delta Model, DSM1, and DSM2 have one thing in common: they have been done manually, with some graphs and statistics to aid in deciding how to adjust Manning's N and dispersion coefficients. Mathematically-based methods² have existed for years to adjust calibration coefficients objectively, but these methods were developed, and have been largely used, in groundwater modeling. It is DWR's intention to perform the next full calibration using these techniques as expressed in the PEST program,³ and to that end, Delta Modeling is working on a contract with S.S. Papadopoulos & Associates (SSP&A) to assist and advise DWR in applying the PEST program to DSM2.

A significant improvement in observed data is the development of a series of Digital Elevation Models (DEMs)



of Delta bathymetry.⁴ The DEMs use a number of sources of recent bathymetry measurements and should be used to revisit DSM2 cross sections. To this end, a contract is being developed to replace the old CSDP program⁵ with one based on ESRI ArcGIS products. Since the DEMs have already been processed and “smoothed” from raw bathymetry measurements, the new program should be able to automatically generate cross-sections at locations best for DSM2-Hydro computations. Users will still be able to manipulate the generated cross-sections to correct errors and perform channel dredging for studies.

Both contracts have been informally approved in the DWR’s Bay-Delta Office. Once in place, they are expected to run about a year. It will be possible with these new methods to finally perform an objective, repeatable calibration, quantify the improvements of different changes to the DSM2 system, and estimate error in DSM2 output for studies.

¹ <http://modeling.water.ca.gov/delta/reports/annrpt/2001/2001Ch2.pdf>

² For instance, <http://pubs.usgs.gov/sir/2010/5211/>

³ <http://www.pesthomepage.org/Home.php>

⁴ http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/AR2012/Chapter%206_2012_Web.pdf

⁵ <http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/models/csdp/csdp.cfm>

DSM2 GENERAL TRANSPORT MODEL (GTM) DEVELOPMENT UPDATE

En-Ching Hsu, Engineer WR, DWR & Nicky Sandhu, Senior Engineer WR, DWR

The Delta Modeling Section is currently developing a General Transport Model (GTM) for simulating transport of in-water constituents. GTM is a one dimensional transport model with an Eulerian fixed-frame of reference. It is based on a Partial Differential Equation solver for the Advection-Diffusion-Reaction equation of concentrations of constituents. GTM is intended to be a flexible and reusable model, enabling a relatively easy integration of additional water quality parameters such as sediment and mercury. Key coding design strategies are:

- A flexible, modular design in Fortran 90;
- Separate input/output routines to aid generalizing to other codes;

- Generalized Eulerian transport coding that is adaptable to other constituents;
- A self-documenting code using Doxygen;
- Companion testing routines using FRUIT (Fortran Unit Testing Framework).

Prior to DWR taking the development lead, sediment transport model (STM) development was a joint effort between DWR and UC Davis. Under the supervision of Jamie Anderson and technical guidance of Eli Ateljevich, a transport module which includes advection, diffusion and reaction was developed for a simple network problem. Testing of convergence and code stability were also performed for different scenarios. In order to integrate this module with DSM2-Hydro – either offline or in a parallel manner – important goals are:

- Adopting an input and output system that is similar to the existing I/O in DSM2-Qual, thereby reducing the learning effort and allowing easy transition between DSM2-Qual and DSM2-GTM;
- Improving spatial resolution and accuracy by using flow and water surface elevation outputs at each computational point instead of at the relatively coarse DSM2 nodes. DSM2-Hydro has already been modified to provide more detailed output in the Hydro tidefile. Further spatial and temporal interpolations for flow and area are performed to create finer GTM grid cells for simulation;
- Applying the transport module to the entire Delta network by accounting for and testing tidal flows, boundaries, junctions and reservoirs;
- For the near-term, simulating conservative constituents such as EC to ensure model is producing reasonable results;
- Designing the core GTM module to simulate Advection-Diffusion and delegating reaction rates to external modules. At this time, the external modules planned are a Sediment module, a Dissolved Oxygen module, a Temperature module and a Mercury Cycling module.

DSM2 PARTICLE TRACKING MODEL UPDATE

Xiaochun Wang, Senior Engineer WR, DWR

Delta Simulation Model II (DSM2) Particle Tracking Model (PTM) simulates the transport and fate of individual notional particles through the Sacramento – San Joaquin Delta. The model was developed by California Department of Water Resources using an algorithm formulated by Dr. Gilbert Bogle in 1993. Since then, the model has evolved with the addition of new features such as attaching of fish-like behaviors to the particles. Currently, the model has been redesigned and is going through a major code rewriting to make the model more scalable/flexible to simulate specific fish behaviors for different fish species. The new developments of the model include:

New Code Design for Adding Behavior Features

The PTM code has been redesigned to make it easier for adding more smart-particle-characteristics/fish-like-behaviors. Two additional classes, behavior dictionary and helper, are added to the model. Behavior dictionary classes store behavior instructions according to certain search keys. Both universal and specific behavior instructions can be stored in the dictionary. The helper classes search the dictionary under specific conditions and set up behaviors for particles when and where the behaviors are needed. Because fish migration and survival research is rapidly evolving, the goal of the new design is to set up a frame work so that PTM can accommodate future universal and time/location specific research products/behavior relationships with minimum modification of the exiting model code. Java generic classes are extensively used in the new design to ensure scalability, type safety and reusability. The highlights of the new design are:

1. Adding three types of helpers, swimming, route selecting, and survival helpers to help particles to behave;
2. Delegating behavior calculations from the Particle class to the helper classes so that adding new behaviors will have only minimum impact on the existing PTM code;
3. Scalable for different fish species, helpers and behaviors.

Implementation of Route Selection Behaviors to Particles

An important fish behavior is route selection when fish reaches a junction. Perry et al. (2012) developed a generalized linear model (GLM) to predict the probability of late Fall-run juvenile Chinook salmon route selection at a junction. The model is based on the acoustic telemetry tag data collected at the Georgiana Slough (GS) and Sacramento River (Sac.R.) junction in 2011. The GLM predicts the fish route selection probability on the basis of 1) operation of the non-physical barrier; 2) time of day; 3) flow entering the river junction; 4) the cross-stream, horizontal position of each individual fish; and 5) the location of the critical streakline in the cross section.

The GLM is implemented in PTM. The implementation only applies for the environmental conditions that the GLM is based on – that is, the GLM was only used for the simulation when a particle reaches the GS and Sac. R. junction and under the unidirectional flow condition. The purpose of this implementation was to assess whether the implementation of the behavior relationship (behavior vs. environment) in PTM could substantially improve the model's prediction of fish behavior. The values of the GLM hydrodynamic covariates (flow, depth, width, etc.) and fish locations in the model were simulated by DSM2 Hydro and PTM. Non-physical barrier's operation was obtained as the model input. All simulations assumed daylight conditions because light intensity data are currently not available. The simulation with the GLM implementation agreed reasonably well with the field observation, especially under the low flow conditions. This indicates that the PTM is able to predict certain fish behavior as long as an adequate fish behavior relationship is implemented.

Implementation of Survival Model and Refinement of Flow Field

Many other fish behaviors could affect fish migration through the delta. For example, survival behavior determines fish survival through the delta. A reach by reach and age dependent survival GLM model (Perry, personal communication, April 11, 2013) has been developed based on

the acoustic telemetry tag data collected. The implementation of the survival model to PTM is underway.

The PTM flow field simulation can also be improved. A computer program to interpolate for a finer resolution flow field in the delta will be available later this year. The program will interpolate DSM2 Hydro outputs for a higher resolution grid using sophisticated interpolation schemes. The improvement to the quasi-three-dimensional velocity profiles is also taken under consideration.

Open Source Project for Collaboration

Collaboration is an important aspect of the PTM development. Delta Modeling Section welcomes the contributions to the PTM development from other agencies and private firms. An open source project website has been set up in the Google Open Project website. The website is under regular improvement to allow other public agencies and private consultant firms to collaborate on and contribute to the PTM behavior development.

It is expected that when more behavior relationships are established for wider ranges of environmental conditions and are implemented in PTM, the model will be able to predict behavior patterns more accurately and help to identify the factors that affect fish behaviors and survival in Delta.

Reference

Bowen, M., Hanson, D., Perry, R. et al. (2012). "2011 Georgiana Slough Non-Physical Barrier

Performance Evaluation Project Report". Agent Review Draft. California Department of Water Resources.



DYE STUDIES AND DSM2 MODELING TO CHARACTERIZE THE FATE OF EFFLUENT FROM THE CITY OF VACAVILLE IN THE DELTA

Gang Zhao, Project Engineer, Flow Science Incorporated, Susan Paulsen, President and Principal Scientist, Flow Science Incorporated, and Tony Pirondini, Water Quality Permitting Administrator, City of Vacaville.

Introduction

The City of Vacaville's (the City's) Easterly Wastewater Treatment Plant (EWWTP) discharges secondary treated effluent to Old Alamo Creek immediately east of Elmira, California (*Figure 1*). The creek system downstream of the discharge point includes New Alamo Creek, Ulatis Creek, and Cache Slough (*Figure 1*). Field dye studies and DSM2 simulations were conducted in 2011 as part of the City's Easterly Wastewater Treatment Plant Water Quality Monitoring Plan: Data Collection for NPDES Permit Renewal and Receiving Water Effects Assessments (Water Quality Monitoring Plan). The 2011 studies included near-field studies, which were conducted in the Old Alamo-New Alamo-Ulatis Creek system upstream of the area of tidal influence, and far-field studies, which were conducted in the Cache, Haas, Lindsey and Barker Slough areas of the Delta, where mixing and dilution are influenced by tides.

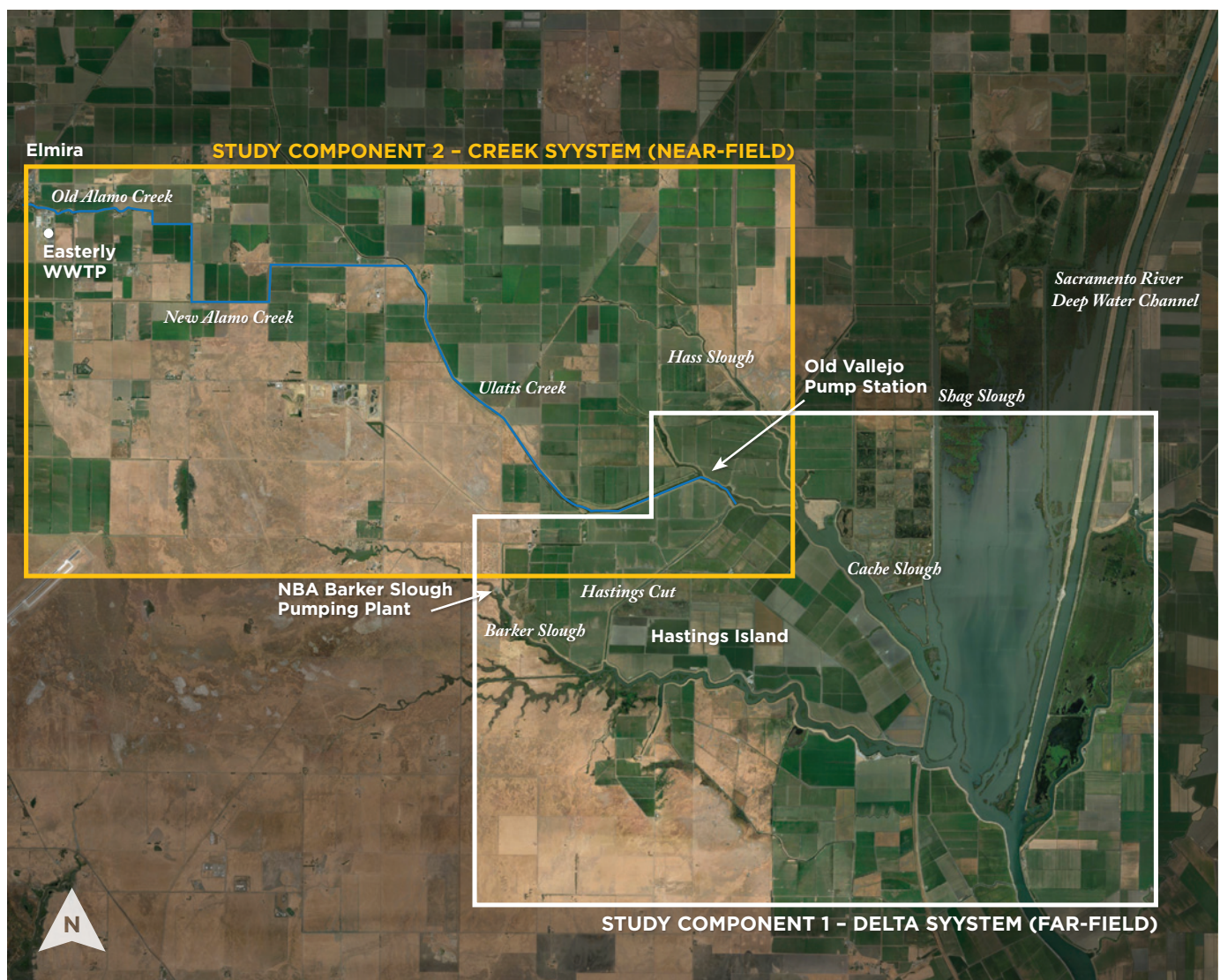


Figure 1 – Dye study location map. (Source: Brown and Caldwell 2012).

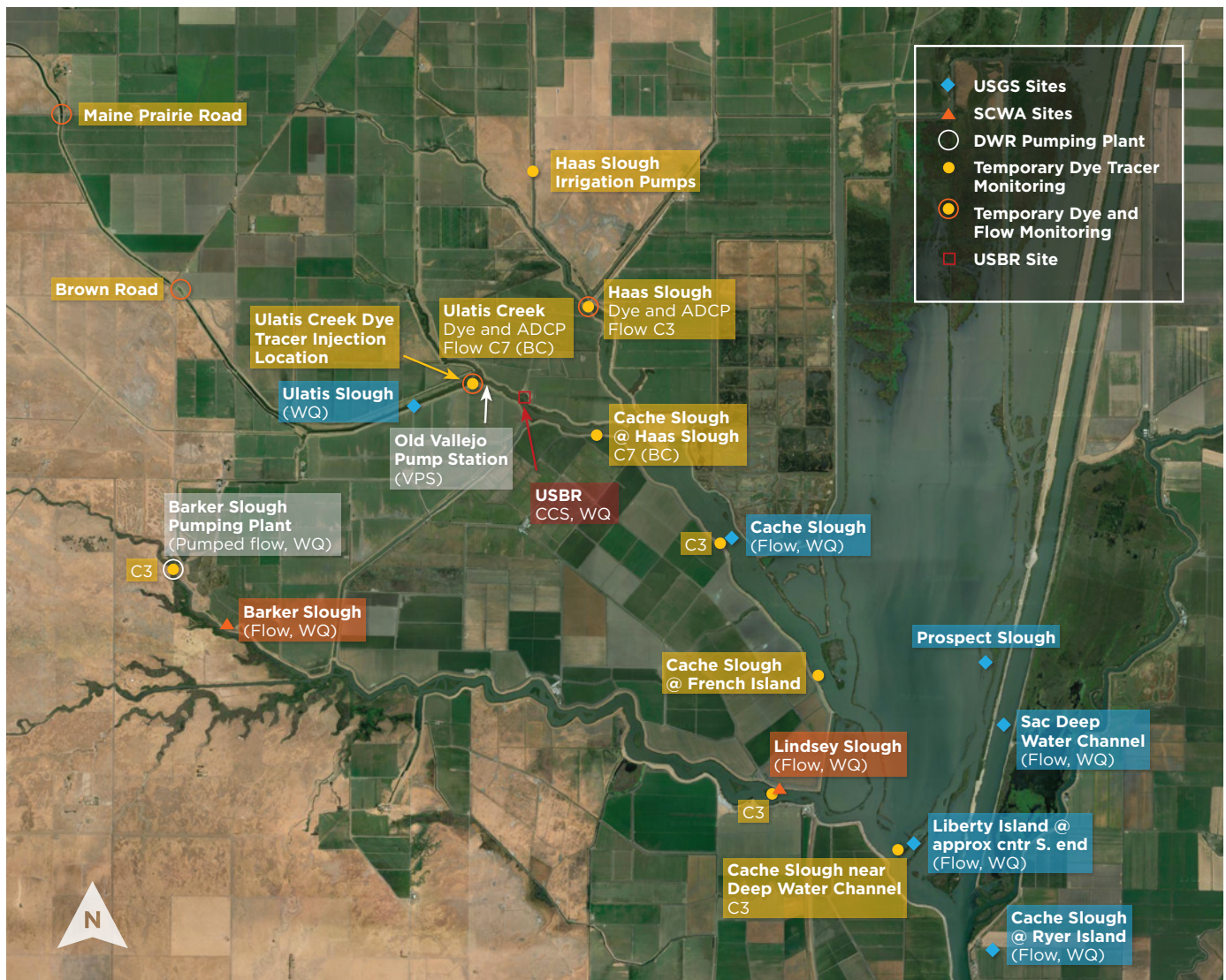


Figure 2 - Location of fixed stations (source Brown & Caldwell 2012).

Specific objectives of the near-field dye studies were:

- To characterize the near-field transport and dilution of EWWTP effluent as it mixes within the creek system prior to entering Cache Slough, during wet and dry seasons.
- To estimate dilution and effluent losses due to agricultural activity during wet and dry seasons.

Objectives of the far-field dye studies were:

- To characterize far-field transport and dilution of EWWTP effluent as it mixes with the tidally influenced receiving waters in the Delta.
- To validate a model of the Delta to simulate the dilution and transport of EWWTP effluent as it mixes with water in the Delta, and to use the model to characterize the dilution and transport of EWWTP effluent within the Delta for a two-year period that included a range of hydrologic conditions.

Flow Science worked jointly with Brown and Caldwell, Robertson-Bryan Incorporated (RBI), and City staff to conduct the field dye studies.

Field Dye Studies

Two near-field dye studies were conducted in March and July 2011 to characterize the transport and dilution of the EWWTP effluent in the creek system under wet weather conditions and under dry weather conditions with agricultural irrigation and diversions. Data collected in the creek system showed that dilution of the EWWTP effluent at Ulatis Creek (downstream of Brown Road) was approximately 20:1 to 50:1 in the March (wet weather) study and 11:1 in the July (dry weather) study. The July study also showed that only about 28% of EWWTP effluent reached Cache Slough due to agricultural diversions of water from the creek system.

Three far-field dye studies were performed in April, August and November 2011 to study the transport and dilution of the EWWTP effluent as it enters Cache Slough and the Sacramento-San Joaquin Delta System, and to investigate the potential for the diluted effluent to travel through Cache Slough and Barker Slough to the intake of the North Bay Aqueduct (NBA). In addition, data from the far-field dye studies were used to validate DSM2 modeling of the fate of EWWTP effluent in the Delta. The validated DSM2 model was in turn used to model the fate of the EWWTP effluent within the Delta over time and for a range of hydrologic conditions.

During each far-field dye study, rhodamine WT dye was injected at a constant rate for approximately 12 hours through a temporary diffuser across Ulatis Creek near the former Vallejo Pump Station (VPS). The resulting dye plume was then monitored using both boat-mounted instruments and continuous in-situ measurement instrumentation deployed at key locations (*Figure 2*) in the channel network, where grab samples were also collected. Data from the far-field dye studies indicated that dilution ratios at the Cache Slough USGS site were higher than 30:1, and dye concentrations were consistently at background levels (< 1 ppb) at French Island, Lindsey and Barker Sloughs.

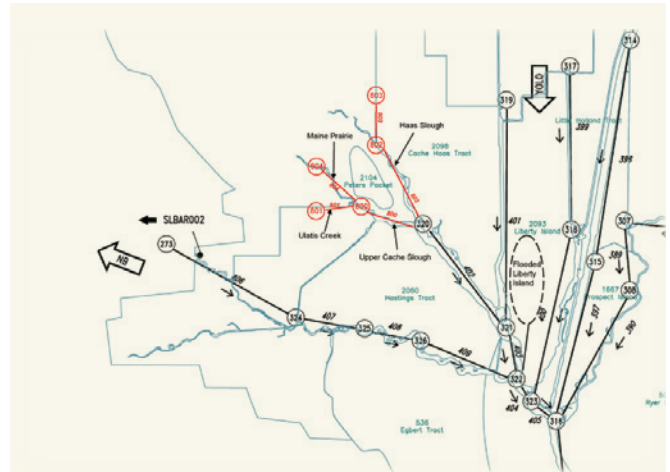


Figure 3 – Modified DSM2 grid (Channels and nodes in red were added for this study)

DSM2 Validation

The DSM2 model grid from the 2009 mini-calibration was used as the base for simulating the far-field dye studies. The 2009 model grid did not include Upper Cache Slough, Haas Slough, or Maine Prairie Slough. To simulate the far-field dye studies, five nodes and five channels, shown in *Figure 3*, were added to the DSM2 model grid to cover the Cache-Haas Slough area. Channel bathymetry data from the DSM2 Cross Section Development Program (CSDP) were used to set the depth and cross-sections of the five added channels.

A tracer was introduced into the model at the newly added node where Maine Prairie Slough joins Ulatis Creek to simulate dye injection. Although background fluorescence was detected in field measurements from the far-field studies at French Island and in Lindsey and Barker Sloughs, the background levels were low and fluctuated with time. The low level of background fluorescence was not simulated in the model.

River flow and stage data from the California Data Exchange Center (CDEC) were processed and used as boundary inputs to the DSM2 model. Ulatis Creek flow and the agricultural diversion at the end of Haas Slough were set using data from the dye studies and from historical measurements.

To validate DSM2 simulations with the modified grid, simulated dye concentrations were compared with dye data collected from both boat-mounted sensors and equipment

deployed at fixed stations during the three far-field dye studies. *Figure 4* compares simulated dye concentrations to data collected along the boat transects during the April far-field study. For all three far-field studies, sensors mounted on the boat collected dye concentration data twice per day as the boat traveled along Cache Slough. The title “April 2-1 CS” in *Figure 4* indicates that the plot is for Cache Slough boat transect 1, on Day 2 of the April study. Results for the August and November studies, not shown due to article length constraints, are similar to the April study.

Model results generally agreed well with measured data. For all three far-field studies, the modeled dye plume appeared to move more slowly on the first day following the dye release than the measured data. This apparent difference in behavior occurred because the 1-D DSM2 model assumes

a uniform dye concentration over a channel’s cross-section, and both water and dye in DSM2 channels move at the channel average velocity; by contrast, the actual dye tracer was injected at the water surface and would have taken some time (likely one to two tidal cycles) to mix with ambient river water over the depth and throughout the cross-section. Water at the surface of a stream channel generally moves at a velocity higher than the channel average velocity. Therefore, the DSM2-modeled dye plume lagged behind the measured plume on the first day after dye release. For a long-term discharge, the effluent plume becomes well-mixed with ambient water after some time, so the uniform concentration assumption in DSM2 will not be an issue in simulations of long-term discharges.

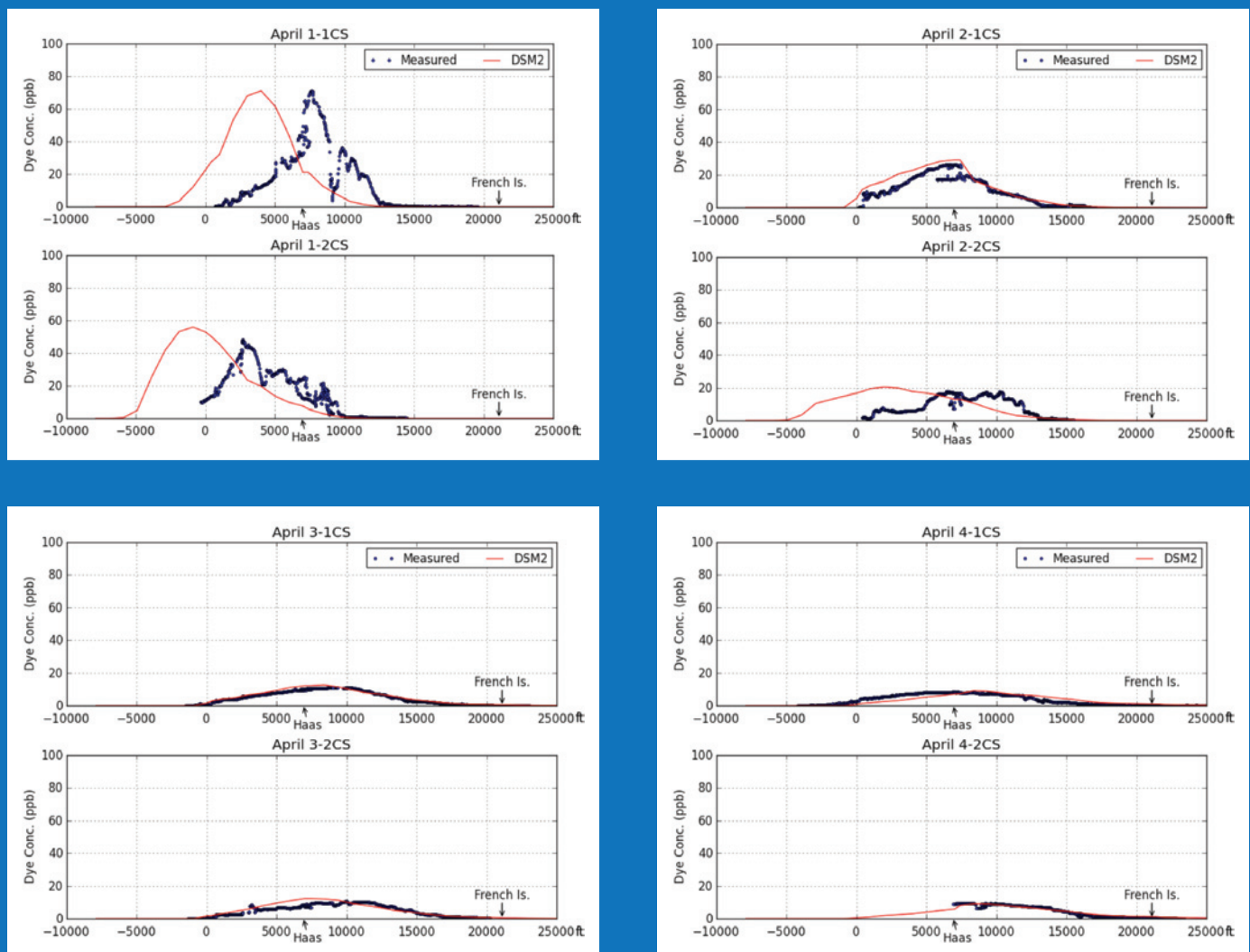


Figure 4 – Simulated and measured dye concentrations along Cache Slough transects for the April study.

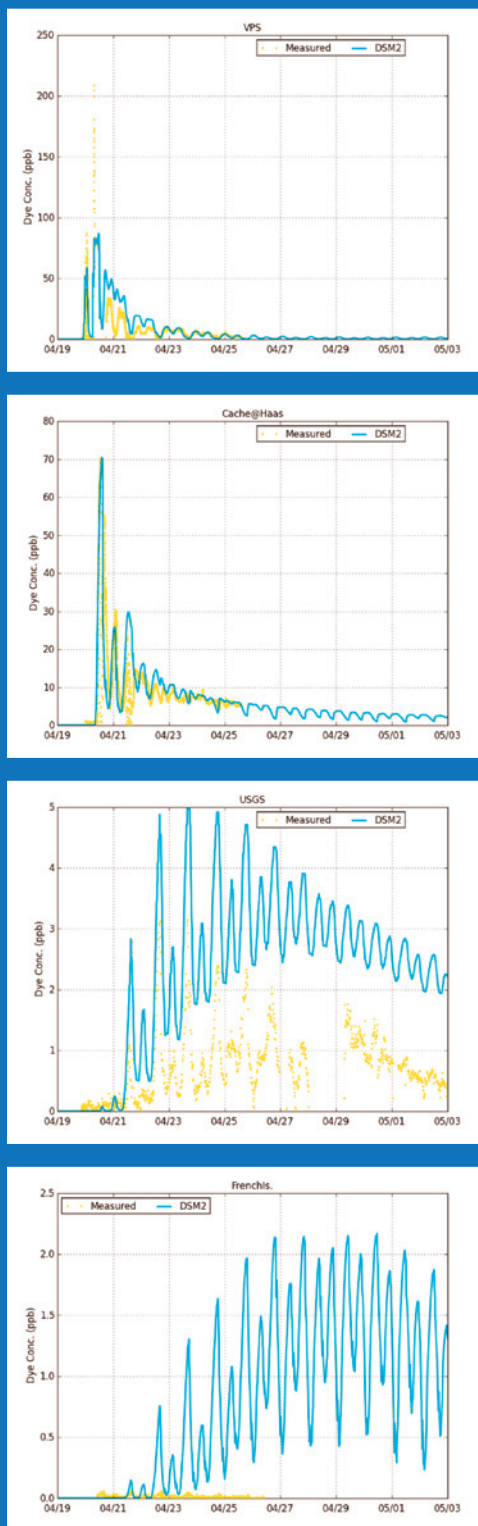


Figure 5 – Simulated and measured dye concentrations at Cache Slough fixed stations for the April study.

Note that the model overpredicted dye concentrations in lower Cache Slough, as shown in the bottom two panels, leading to conservative results (overpredicted effluent concentrations and underpredicted dilution) in this region.

Figure 5 compares DSM2-simulated dye concentrations to dye data collected at fixed stations in the April far-field dye study. Plots for the August and November studies, not shown here, are similar. Model results agreed well with field data at the VPS and at the station just upstream of Haas Slough (first two panels of the figure), except for a few extremely high measured dye concentrations, which resulted from incomplete mixing of the dye during and immediately following the dye injection. Because the 1-D DSM2 model assumes the dye plume is well-mixed, the model is not capable of capturing the high concentration patches near the diffuser at the creek's surface during dye injection.

The DSM2 model overpredicted dye concentrations in Cache Slough at the USGS site and at French Island (bottom two panels of the figure). This overprediction could have been caused by a number of reasons, such as agricultural diversions and return flows that were not modeled in DSM2, and/or a lower DSM2 mixing coefficient for this channel section. More importantly, there are several flooded areas along the channel reach around French Island, forming complicated channel geometry. The DSM2 model grid in this area is simplified, which is likely the primary cause of the over-predicted dye concentrations. Difficulty in capturing the details of the channel geometry and the low measured dye concentrations (< 5 ppb) make improvements to the DSM2 model results at this station difficult and impractical. For the project, the DSM2 model overpredicted concentrations, resulting in conservative model estimates (i.e., dilution predicted by the DSM2 model in the long-term simulation will be underpredicted). Therefore no extra efforts were made to improve the model results in this area.

Modeled dye concentrations also compared favorably with dye data collected from Haas and Maine Prairie Sloughs (results not shown).

In summary, the DSM2-simulated dye concentrations matched field data well for all three far-field dye studies, and the model is considered to be fully validated. Although some discrepancies were noted, the DSM2 model was conservative in that dye concentrations were overestimated.

Modeling of Long-term Discharges

Although data from the three far-field dye release studies showed that dye concentrations were at background levels in Barker Slough, which supplies water to the North Bay Aqueduct (NBA), the dye plumes in these studies were produced by injecting dye into Ulatis Creek for a twelve-hour period. To address concerns that effluent could accumulate to higher levels for a continuous discharge, the DSM2 model was used

to simulate the EWWTP effluent discharge for a two-year period that included both wet and dry hydrologic conditions.

Water years (WY) 2006 and 2007 were selected as the period for this model simulation because WY 2006 was a wet year and WY 2007 was a dry year for the Sacramento Valley. The amount of EWWTP effluent reaching the downstream end of Ulatis Creek was adjusted using the near-field dye study data to account for dye (and effluent) loss during the irrigation season. The adjusted EWWTP effluent flow rate was used as a DSM2 input at the newly added Ulatis Creek node, and concentrations of EWWTP effluent were tracked at key locations in the Cache Slough, Lindsey Slough, and Barker Slough.

Modeled concentrations of EWWTP effluent at Barker Slough are presented in *Figure 6*, which shows that predicted effluent concentrations were less than 0.32% (i.e., dilution ratio greater than 300:1) for WYs 2006–2007, and were below 0.16% (i.e., dilution ratio greater than 600:1) for July through September of both years. In addition, the model overpredicted measured dye concentrations (i.e., underpredicted dilution) at French Island and at the USGS station in Cache Slough, well upstream of Barker Slough; thus, the model-predicted effluent concentrations at Barker Slough should also be regarded as upper bounds on the actual concentrations of effluent at this location (i.e., the dilution estimates should be regarded as lower bounds).

An Anecdote

The project team working hard preparing for the November study was captured in a Google Earth image (*Figure 7*). You never know who is watching!

Acknowledgements

Flow Science wishes to acknowledge Rhys McDonald and his colleagues at Brown and Caldwell, and staff at the City of Vacaville, for their expertise, professionalism, and good humor in conducting the field dye studies.

Reference

Brown and Caldwell (2012). "Far-Field Dye Mixing Studies Data Report", Data Report No. DR-1, August 30.

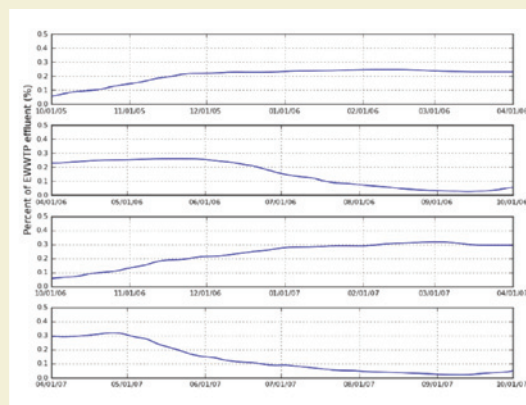


Figure 6 – Modeled concentrations of EWWTP effluent at Barker Slough NBA intake (WY 2006-2007).

Note that an effluent concentration of 0.5% corresponds to a dilution of 200:1.

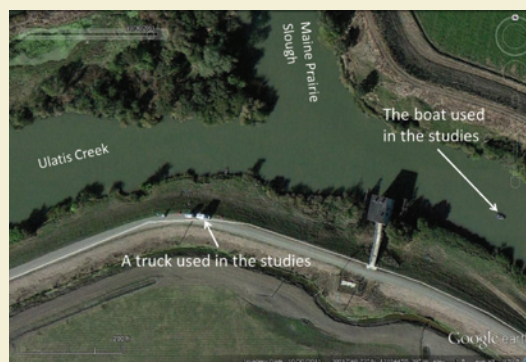


Figure 7 – The team hard at work!

FRANKS TRACT PROJECT FEASIBILITY STUDY

Kyle Winslow, Senior Water Resources Technologist, CH2M HILL

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) is evaluating the feasibility of new facilities and operations in the central region of the Sacramento – San Joaquin Delta (Delta) near Franks Tract to influence hydrodynamic conditions to improve Delta water quality and reduce entrainment of fish at the Central Valley Project (CVP) and State Water Project (SWP) export locations in the south Delta. The primary planning objective of the Franks Tract Project (project) is to modify Delta hydrodynamic conditions to improve water quality in the Delta. The protection and enhancement of conditions that benefit fish species of concern in the Delta is a secondary planning objective of the project.

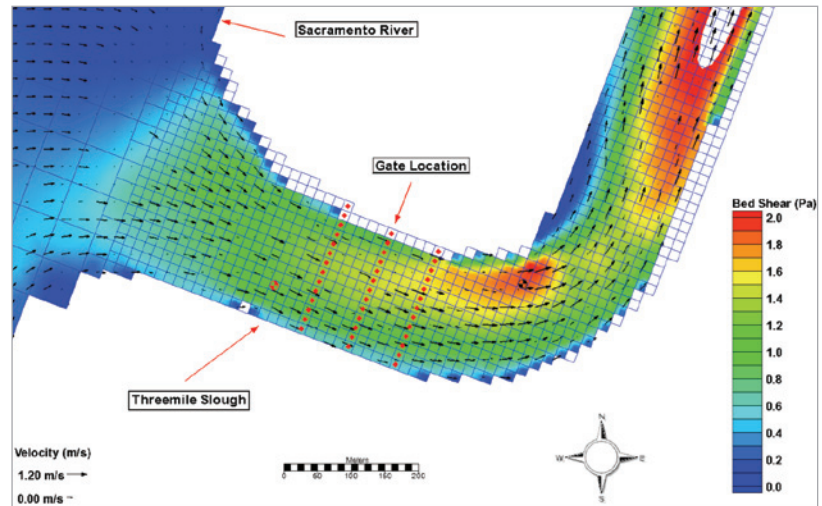


Figure 1 - Bed Shear at Peak Flood Tide.

CH2M HILL conducted a series of technical studies in support of the overall Feasibility Study of the Franks Tract Project. These studies were undertaken to quantify the effects of operable barriers in Threemile Slough on hydrodynamics, water quality, sediment transport, system-wide water operations, and fisheries conditions in the vicinity of the project site and throughout the Delta. Hydrodynamic and water quality modeling were conducted with DWR's Delta Simulation Model II (DSM2), which looked at long term changes in delta conditions for various gate operation alternatives. The DSM2 model was run in an iterative fashion with the Franks Tract Water Operations Model (FT-WOM) to account for expected changes in reservoir and export operations associated with the predicted improvements in regional water quality brought about by gate operations. Benefits of the proposed project, including improved water quality, an increase in water supply, and the ability to reduce entrainment of fish into the South Delta, were quantified through the modeling analysis. The project also included a significant economic analysis component, which developed cost-benefit summaries of the project, including benefits to water treatment, water supply, and fisheries.

Threemile Slough is a tidal channel connecting the Sacramento River and the San Joaquin River upstream of their confluence. Tidal flows through Threemile Slough peak at over 30,000 cfs. Asymmetry in the tidal currents in Threemile Slough associated with the variable speed of progression of tidal waves in the Sacramento and San Joaquin Rivers yield a net flow on the order of a few thousand cfs from the Sacramento River to the San Joaquin River. A series of bottom-hinged radial gates have been proposed as a way to influence local hydrodynamics for the improvement of water quality and the benefit of fisheries.

Sediment Transport

A sediment transport analysis was conducted to determine the effect of the proposed project on the sediment transport through Threemile Slough. Field data indicate that large sand dunes are present along the channel bottom in portions of Threemile Slough. High resolution bathymetry of the dune fields in the eastern portion of Threemile Slough taken over a one week period indicate sediment transport rates on the order of 100 tonnes per day. The sediment transport analysis was conducted in part to determine if the bed load transport of sand could interfere with the operations of the bottom hinged gates, which lay parallel to the channel bottom when not in operation.

The sediment transport analysis was conducted with the US Army Corps of Engineers (USACE) Coastal Modeling System – Flow Model (CMS-Flow), a two-dimensional, depth-averaged finite-volume model that solves the depth-integrated equations of mass and momentum conservation. The model calculates sediment transport and morphological change with time throughout the model grid through functional relationships based on predicted bed shear (*Figure 1*). CMS-Flow was calibrated to match predicted velocities from the 3-dimensional UnTRIM model recently developed by RMA. Sediment transport results could not be calibrated because of a lack of rigorous data, but results for tidal transport compared favorably with other historic measurements.

Model results were analyzed and the total transport was aggregated on a tidal basis to determine variations in the transport between flood tide and ebb tide as well as variations through the spring-neap tidal cycle. Regressions were developed between local velocity and total sediment transport from CMS-Flow model results. These regressions were then used with extended time series of predicted velocity from the one-dimensional Delta Simulation Model II (DSM2) to predict annual sediment transport under baseline and with project conditions. Results indicate an annual increase in transport of 21 percent for fine sands; this provides a likely upper bound on the influence of the project because fine sands comprise only a portion of the local bed sediment.

USING DSM2 TO DEVELOP LEGAL EVIDENCE CONCERNING IMPACTS OF SWP OPERATIONS ON NORTH DELTA HYDRODYNAMICS

Siqing Liu, Engineer WR, DWR & Bob Suits, Senior Engineer WR, DWR

This past year, results from DSM2 simulations were used by DWR to develop information in support its defense of a lawsuit filed by Cortopassi Partners and Reclamation District 2086. DWR was sued for breach of its 1981 contract with North Delta Water Agency and for private nuisance. After 27 days of testimony, Judge Linda Lofthus ruled for the defense. This article briefly summarizes how DSM2 simulations were used by DWR in the case.

Background

Cortopassi Partners, which owns property on Canal Ranch adjacent to the South Fork of the Mokelumne River, claimed that conveyance of SWP water through the DCC and Georgiana Slough had caused a build-up of silt in the South Fork and lower Mokelumne River. The plaintiffs claimed that this in turn has caused two negative impacts: siphons along Canal Ranch have had to be replaced due to being silted in and water levels in the South Fork of the Mokelumne River during high flow events are higher than in the past, increasing the flood risk to Cortopassi's property. The plaintiffs charged that DWR should be held accountable for the siltation in south Fork at Canal Ranch since CVP and SWP waters coming in the Sacramento River and DCC gates are operated according to the coordinated operation agreement between the Bureau of Reclamation and the Department of Water Resources.

Evidence presented by the plaintiffs consisted of an analysis of the differences between a 1934 U.S. Coast and Geodetic Survey bathymetry study and a 2008 multi-beam bathymetry study and various eye-witness accounts of areas of siltation and episodes of color differences between Sacramento River and Mokelumne River flows.

DWR countered that the operation of the SWP via releases from Oroville and pumping from Banks Pumping Plant have no measurable effect on water elevations in the South Fork of the Mokelumne River and have do not increase propensity for erosion and deposition of sediment in the north Delta. DWR pointed the blame at the Cosumnes and Mokelumne Rivers for any siltation in the South Fork of the Mokelumne rather than from the Sacramento River via the Delta Cross Channel.

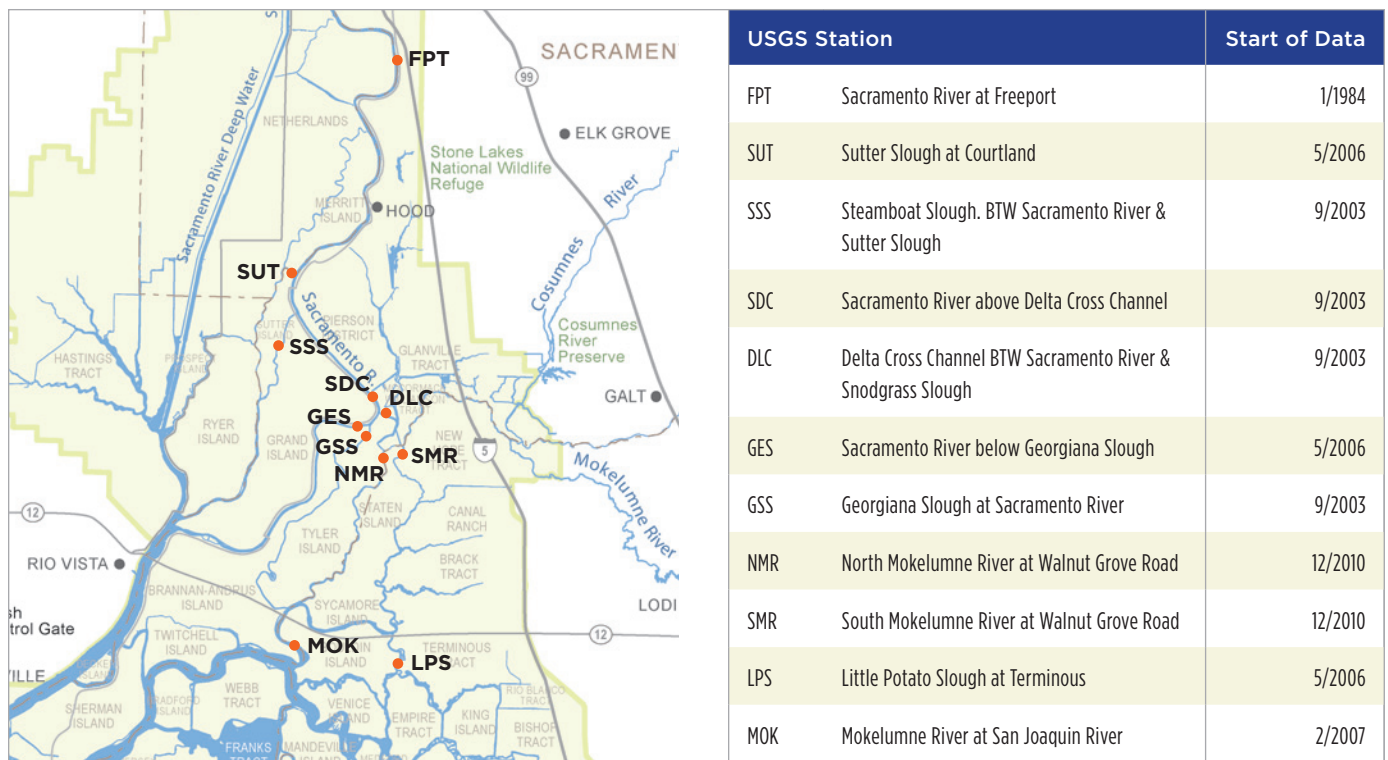


Figure 1 – USGS stations in the north Delta where observed and simulated hydrodynamics compared.

DSM2-based Study Approach

A validation of DSM2 was presented by comparing box and whisker plots based on all available concurrent observed and DSM2-simulated 15-minute stage, flow and velocity values over the period of 1990 to August 2011 (*Figure 1*). In addition, box and whisker plots based on 15-minute stage, flow, and velocity derived from DSM2 were compared to those derived from observed values and an RMA simulation for two periods: July 1-15, 2011 (Delta Cross Channel gates closed) and July 15-31, 2011 (Delta Cross Channel gates open). *Figure 2* shows that the distributions of DSM2 simulated flows well matched those based on observed data at the 11 USGS gauge stations for both Delta Cross Channel gates closed and open conditions. *Figure 3* shows that the 1-D DSM2-simulated flows, velocities and stages in the north Delta also compared well with those simulated by the 2-D RMA model.

Evidence provided by DWR and its consultant was partly based on DSM2 simulations of Delta hydrodynamics and volumetric fingerprints under four scenarios based on historical or modified 1990–August 2011 conditions. The four scenarios were chosen to enable incremental analysis of the effects of SWP operations on north Delta hydrodynamics and source of water. They were: Historical conditions, No State pump, No Federal pump, and No-SWP. Historical conditions used historical inflows and exports and DICU-based consumptive use. The No-State pump and No-Federal pump scenarios eliminated Banks and Jones pumping respectively, leaving historical Sacramento River inflows unchanged. The No-SWP scenario eliminated Banks pumping and modified historical Sacramento River inflow by removing Lake Oroville storage and release of water. *Figure 4* shows an example of the changes to historical Sacramento River inflow resulting from removing Oroville storage and releases for this scenario. To compare the four scenarios, North Delta 15-minute stage, flow, and velocity values were analyzed and presented via box and whisker plots under Delta Cross Channel gates closed and open conditions.

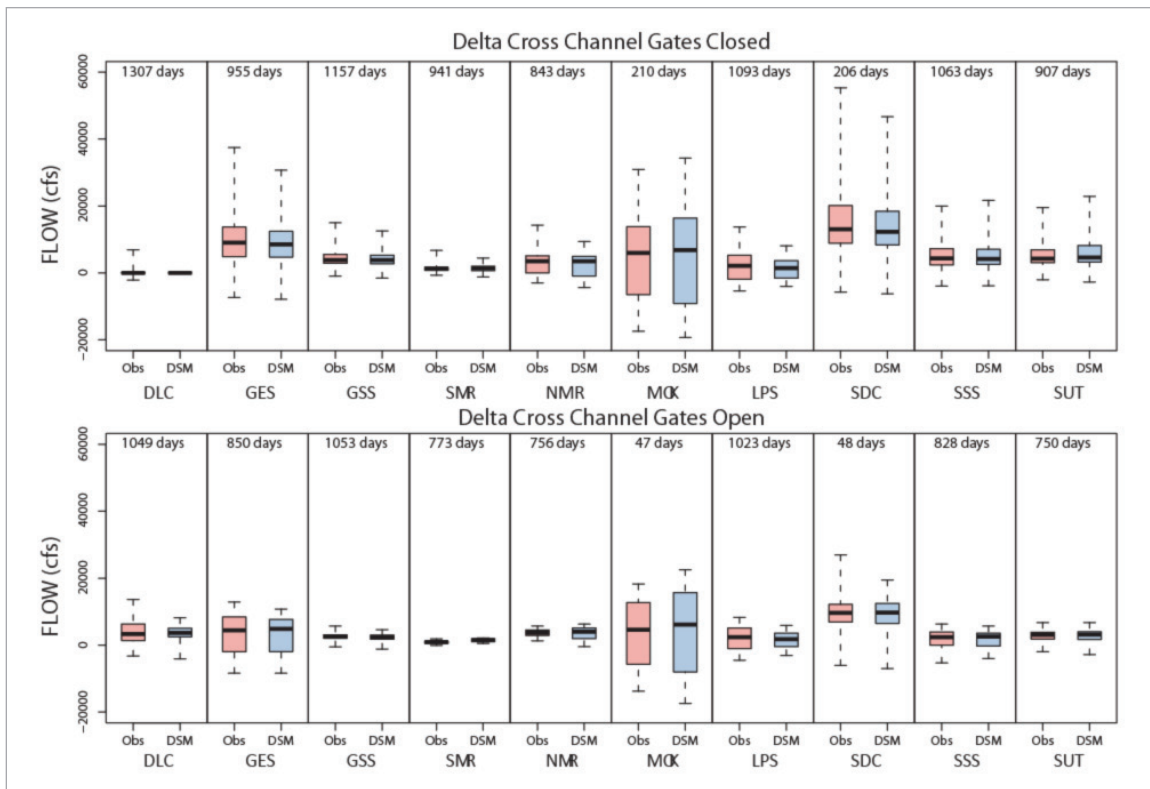


Figure 2 – Distribution of 15-minute flows: DSM2-simulated and observed, 1990–2011.

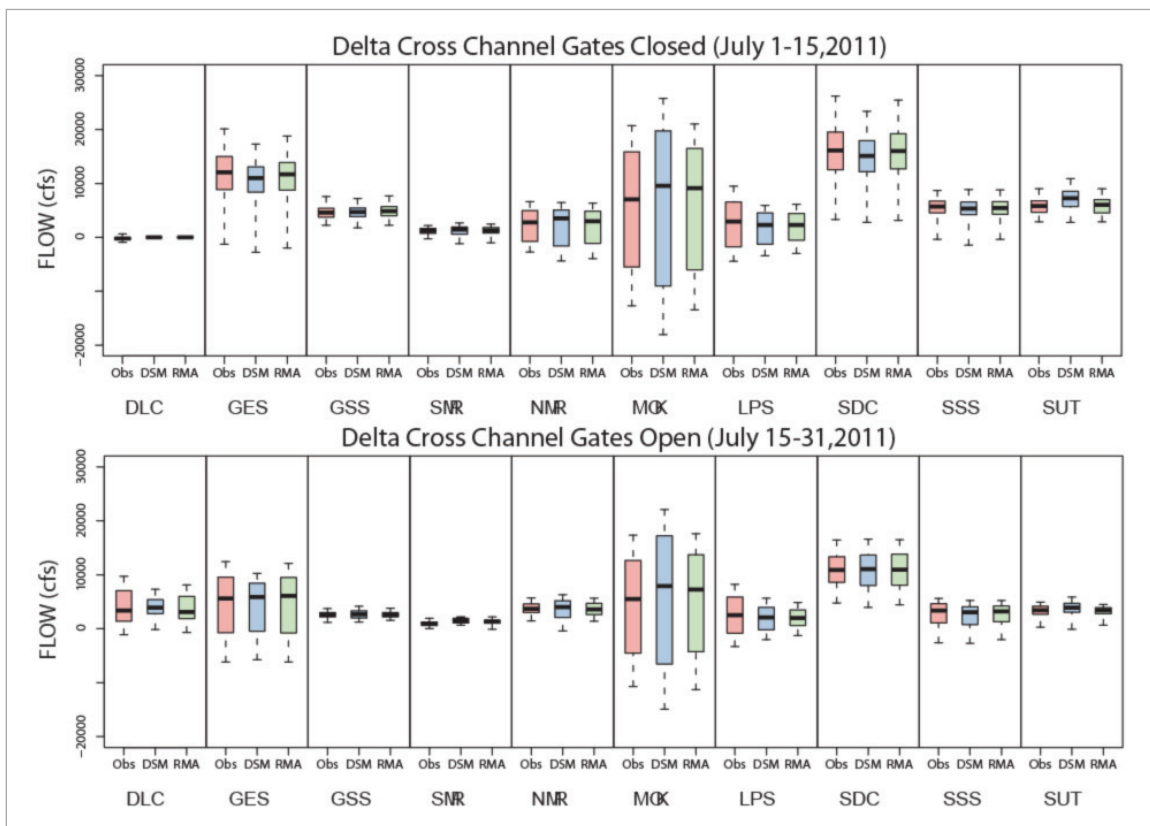


Figure 3 – Distribution of 15-minute flows: DSM2-simulated, RMA-simulated and observed, July 2011.

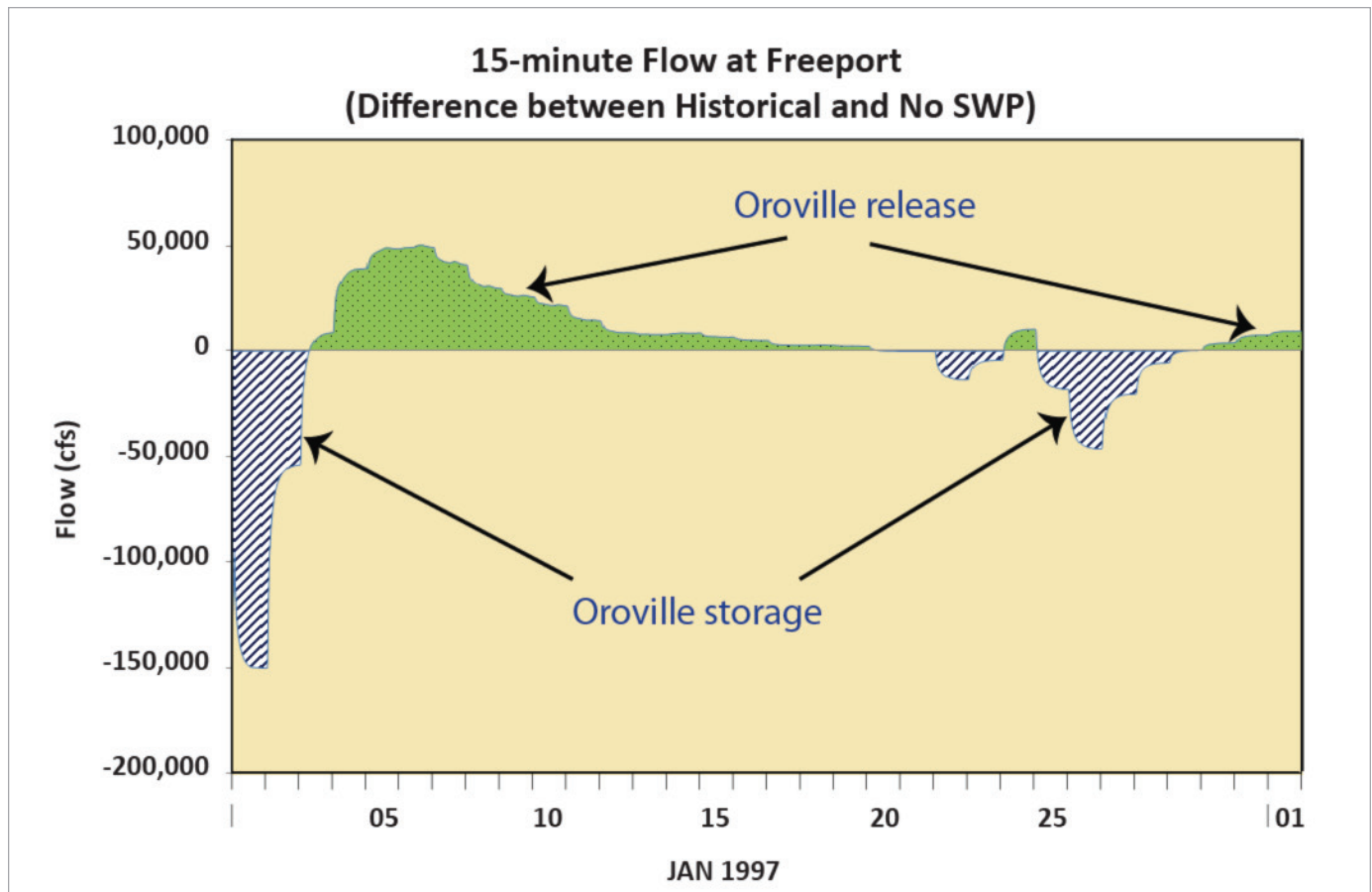


Figure 4 – Sample modifications to Sacramento River inflow to remove effect of storing and releasing water from Lake Oroville.

Results from the Historical scenario were also presented separately in order to describe how the operation of the Delta Cross Channel gates affects both flow splits down the Sacramento River and the source of water in the South Fork of the Mokelumne River adjacent to Canal Ranch.

DSM2-based Study Results

Figure 5 shows flow path of Sacramento River flow at Freeport passes under Delta Cross Channel gates open and closed conditions. The characteristics of the flow split between the North and South Forks of Mokelumne River under Delta Cross Channel gates open versus closed conditions can be seen through volumetric fingerprints in this area (Figure 6). Comparing

distributions of flow, velocity and stage under the various scenarios helps evaluate the extent that Banks Pumping Plant pumping and SWP operations have on hydrodynamics in the north Delta.

Two key claims by the plaintiffs were that water in the south Fork of Mokelumne River flows more slowly than in the north Fork, and there exists a downstream hydraulic dam that impedes the flow of water in the south Fork of Mokelumne River above Little Potato Slough. Through comparing DSM2 results from different scenarios, DWR showed that: 1) tides clearly dominate the North Delta where Georgiana Slough meets the southern end of the North Fork and at the South Fork where it meets Little Potato Slough; 2) Banks pumping by itself has no significant impact on flow through Delta Cross Channel; 3) of water released from Oroville and arriving at Freeport, only about 5% flows down south Fork of Mokelumne River if Delta Cross Channel gates are open; 4) operation of SWP has no obvious effect on hydrodynamics of the north Delta whether the DCC gates were opened

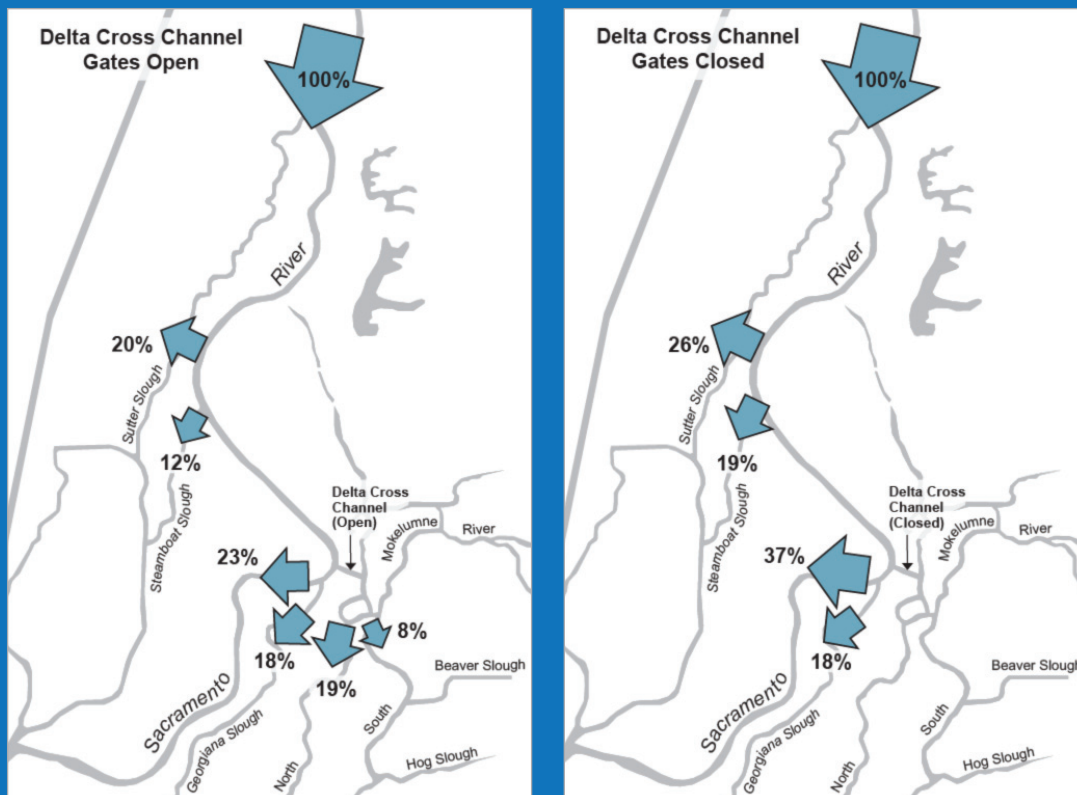


Figure 5 – Downstream distribution of Sacramento River flow at Freeport for Delta Cross Channel gates open and closed.

Values based on DSM2 simulation of historical 1990–August 2011 conditions.

or closed; and 5) At Canal Ranch, the flow in South Fork Mokelumne River increased by 200 cfs, which increased velocity one-tenth of a foot per second, when DCC gates are open. *Figures 7 and 8* show the distribution of flow and velocity in the south Fork of the Mokelumne River for the four scenarios under Delta Cross Channel gates open and closed. *Figures 9 and 10* show 15-minute flow in Georgiana Slough and the lower Mokelumne River area over seven-day periods for Delta Cross Channel gates closed and open. These graphs show the degree of tidal effects comparing Georgiana Slough and the lower Mokelumne River under Delta Cross Channel gates open and closed conditions.

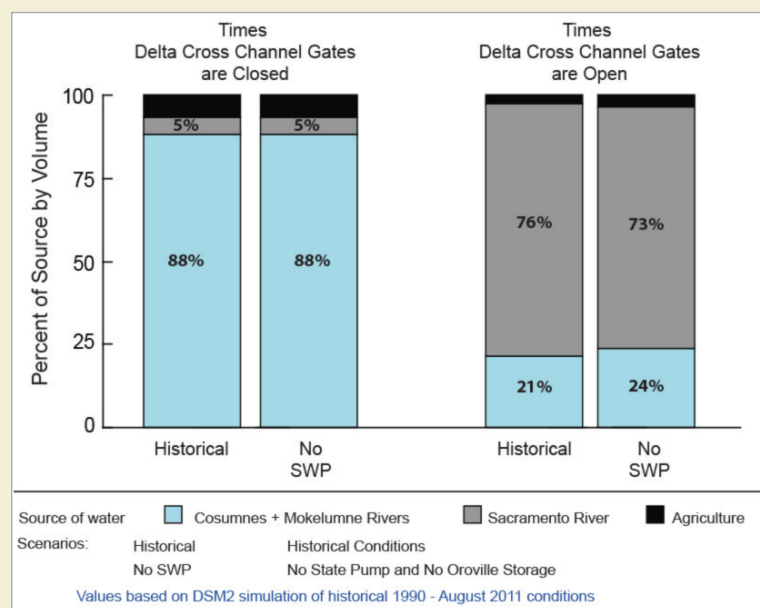


Figure 6 – The origin of water in south fork of Mokelumne River under Historical and No-SWP conditions.

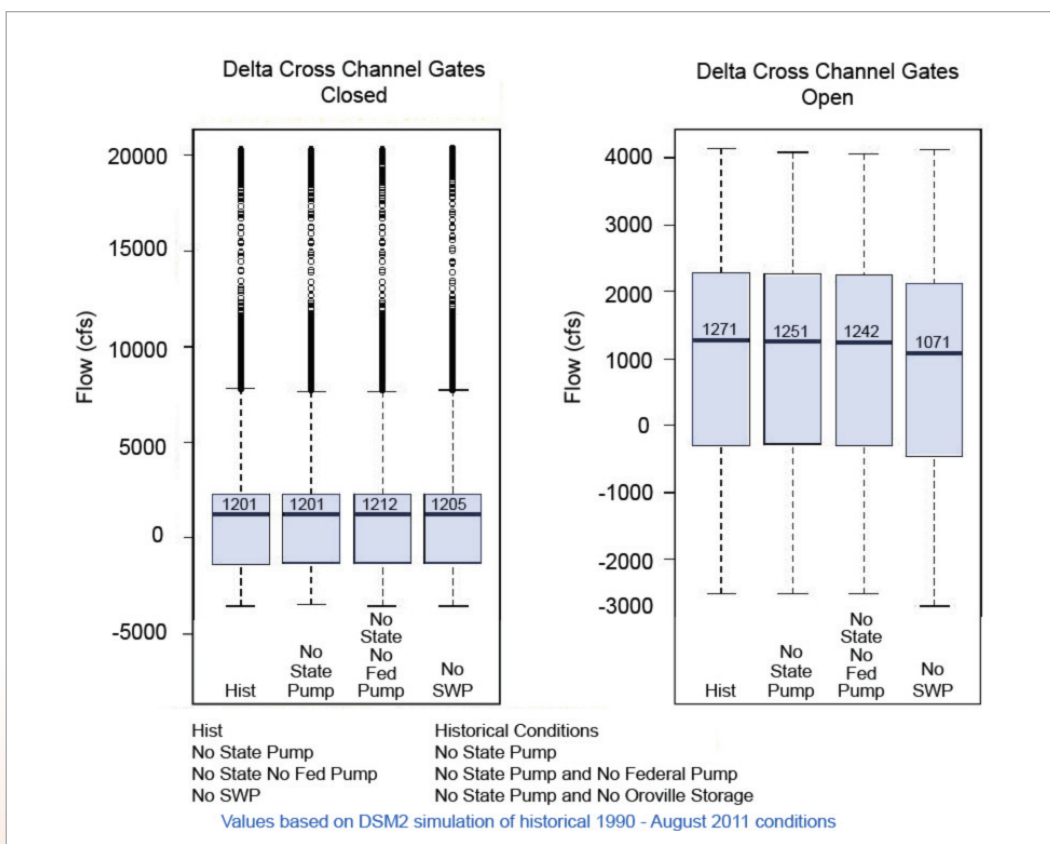


Figure 7 - Distribution of 15-minute flows in South Fork Mokelumne River.

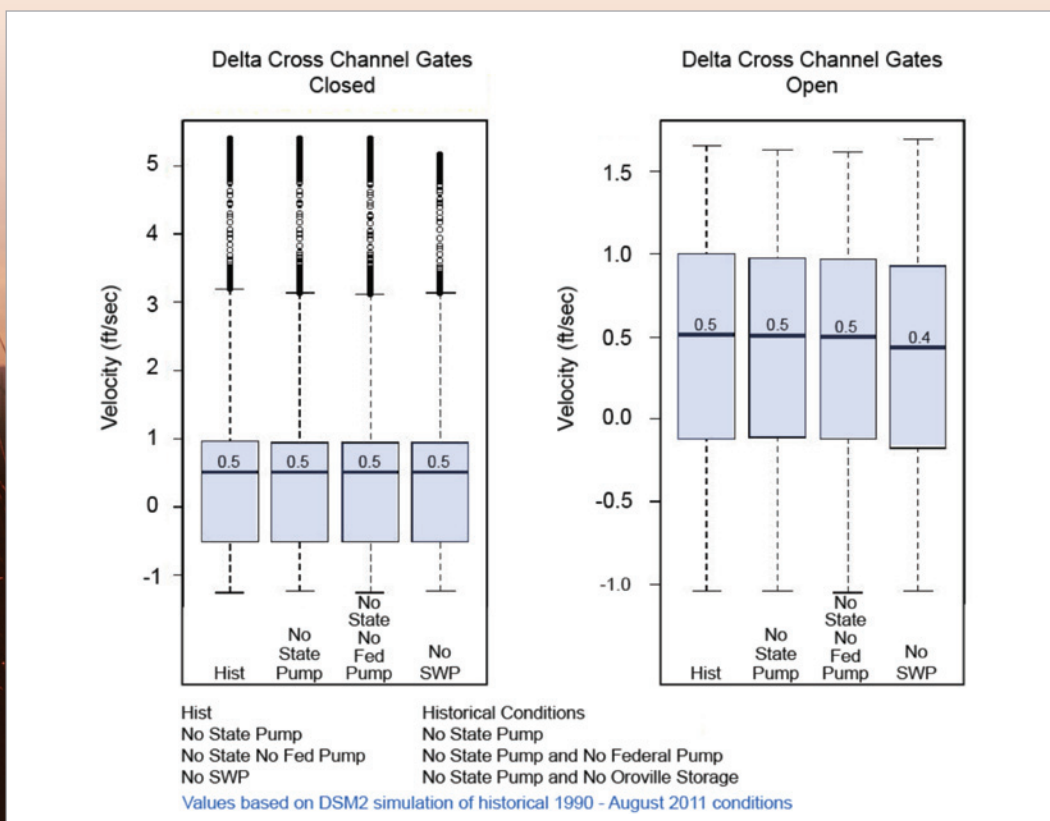


Figure 8 - Distribution of 15-minute velocities in South Fork Mokelumne River.

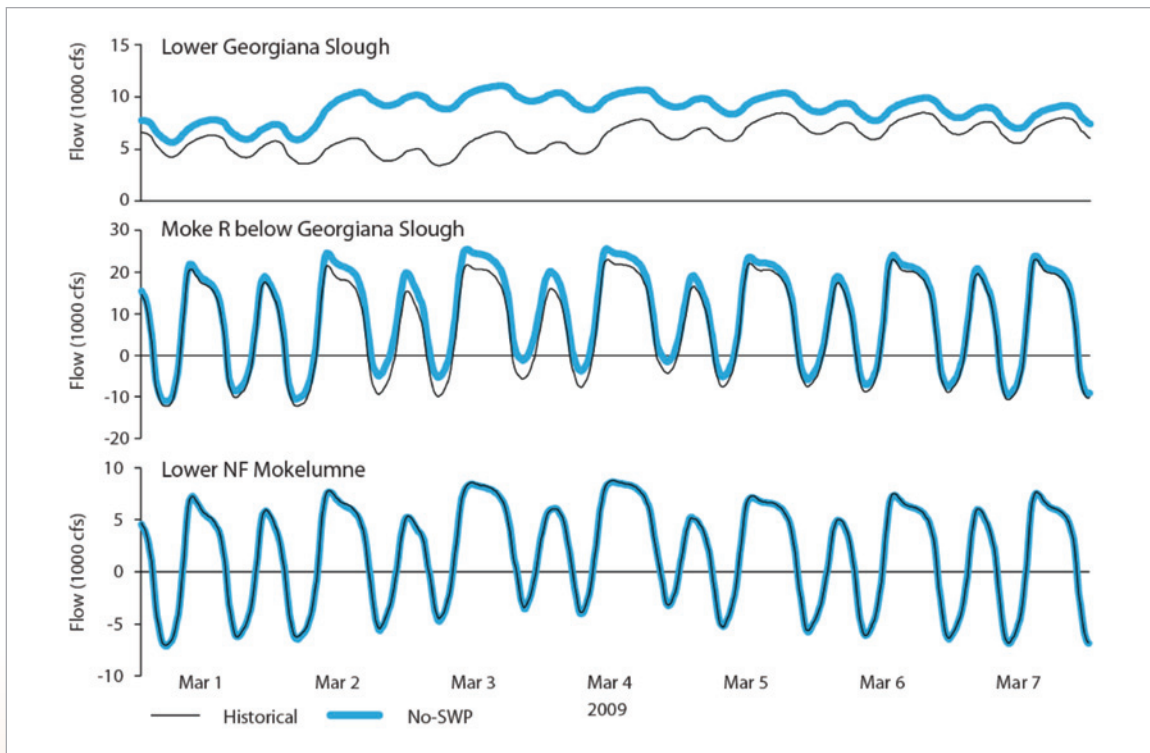


Figure 9 – Flow near lower South Fork Mokelumne River for Historical and No-SWP, Mar 1-7, 2009.
(Delta Cross Channel gates closed, Sac River inflow at Freeport 38,800 cfs)

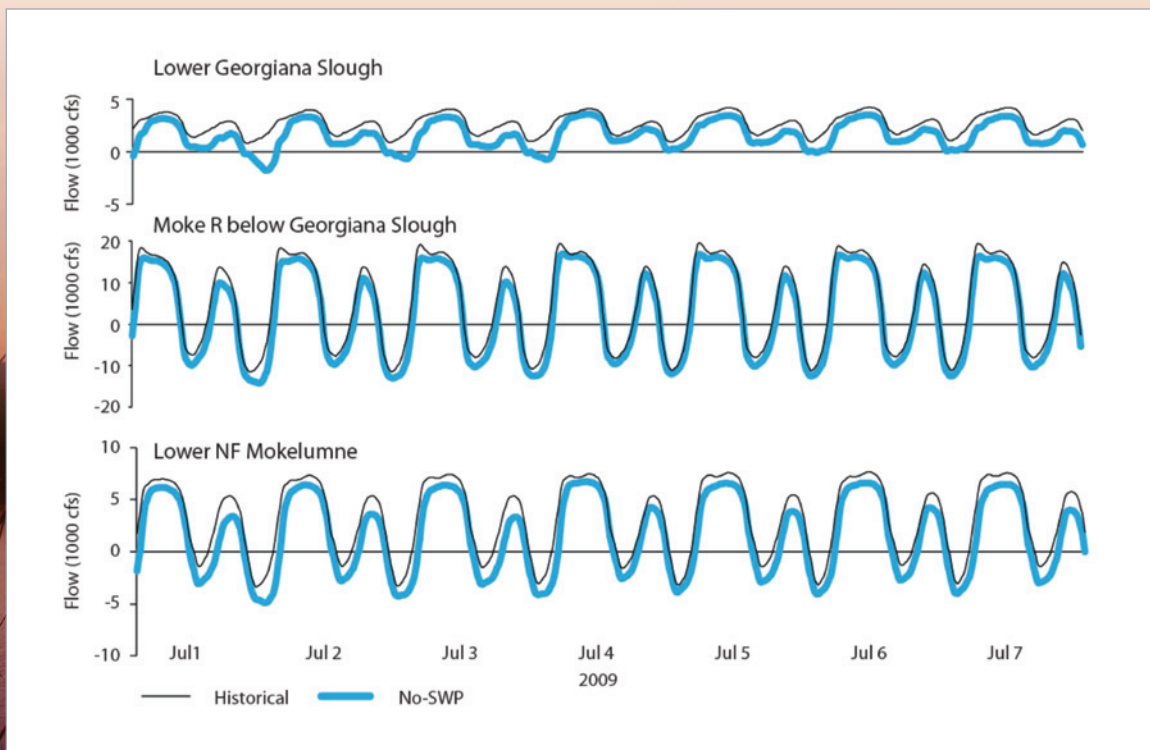


Figure 10 – Flow near lower South Fork Mokelumne River for Historical and No-SWP, July 1-7, 2009
(Delta Cross Channel gates open, Sac River inflow at Freeport 17,020 cfs)

► DSM2UG PEOPLE

TARA SMITH

20 Things You Don't Know About Me

Min Yu, Senior Engineer WR, DWR



In Lake Tahoe after a hike with Rusty (looking longingly at the apple) and Gracie (saving up her energy for the next hike).

Tara, a Supervising Engineer, and Chief of the Delta Modeling Section of DWR, shares her 'secrets' in life with DSM2UG.

1. My First job was doing absolutely nothing for minimum wage (\$2.35/hour). It is actually not that easy to do nothing. I was 15 and the lady across the street needed a model that wore glasses for her water color portrait painting class she was teaching. I fit what she needed. The job was to sit still for two hours each week for three weeks – doing nothing. I suppose my first job was in modeling.
2. I collect tea sets. I think it started when I was given gifts (wedding, birthday) of tea cups and tea sets since most people know that I am a tea drinker. I don't have a lot of sets but a few are very unique and from different parts of the world – clay, iron, china, silver plated.
3. My go-to food are Chai, Chocolate , garlic... (which is too bad for those who have to sit in a meeting with me).
4. I have three brothers. Two older and one younger. The two older brothers live on the east coast in Maryland and Virginia. My oldest brother is married and has two sons. My second oldest brother is married and has two daughters, a son and four grandkids. My youngest brother is married and lives in San Antonio and has a daughter and a son.
5. When I was a kid (about 11) I saw Willy Wonka and the Chocolate Factory around 14 times. This was the version with Gene Wilder. Yes, I used to know the words to all of the oompa loompa songs! I grew up on an air force base and the movies were relatively inexpensive (25 cents) so I went to this particular one often and then watched it on TV when it came there. After the movie came out I decided to build a model of the candy garden with the chocolate river that flowed through it. I got fairly far but ended up eating a good portion of my building materials. I had completely finished the chocolate that was supposed to be used to make the river before giving up.
6. I started Tae Kwon Do when I was a freshman in college at the air force base in San Antonio, Texas. I received my first degree black belt about three years later and then my second degree black belt a few years after that. After I moved to

California, I worked out with a class for a few years and then eventually stopped in my early 30s after 13 years of training.

7. I went into the Engineering field because of my Father's encouragement. My grades were good in the math and sciences due to a great deal of help from my friends in high school. I remember asking him what Engineer's did – to this day sometimes I am still not sure what Engineers do since it is so wide and varied. I liked art but didn't really have a strong passion for a particular direction. My Father was very poor growing up. His Father (who died when he was 8) worked in a factory and so did his Father and his Father's Father. It was not an easy situation to get out of. My Father escaped it by going into the Military where he realized that education was the way to go. He went to night school to get his Bachelors degree and he pushed us to work hard in school (especially my brothers). To my Father Engineering would either provide me with a steady income or I would meet a nice stable Engineer and get married. (My Father was pretty traditional). In any case, I have enjoyed the work I have been doing and really like people I work with.
8. As a military brat I moved around a lot. Before I finished high school I attended 10 different schools. I sometimes think that is why I like traveling but really don't like moving.
9. Although most people in my office might guess Halloween is my favorite Holiday due to my liking to dress up in costume (I am such a goof), Christmas and Easter are actually my favorite Holidays. Christmas is because I love the anticipation of opening gifts in the morning. This usually only works when there are kids involved. It is the night before when there is that excitement of what is to come. Easter is a favorite due more to religious reasons and causes reflection and joy.
10. If I am in a bad mood, exercise, quiet, and a hike make me feel better.
11. I was in the French Club, Track (high jump), the Art club, English club and Math club in high school.
12. I grew up watching old Hollywood movies and when I am feeling nostalgic, I will watch a movie with Katherine Hepburn, Gregory Peck, Gary Cooper, Gene Kelly or some other star from the 40s and 50s. The movies tended to be sweeter and more innocent and it is a good escape. I am pretty open overall to movies although I tend to not prefer movies with a lot of violence.
13. I do stress myself out and have tried several things to reduce it over the years including Tae Kwon Do (kicking a punching bag), Yoga, Tai Chi, hiking and meditation.
14. People have asked me how I met my husband Mike. Well, for those who don't know, the answer is that Mike and I met at Church.

Here is a longer version of the story: Mike had started to come to the Church I went to with his boss/friend and I met him there. At that point in time I was the Social Justice Representative for our Church for the larger Diocese organization. When he was introduced to the Church, his occupation was mentioned to the parishioners. He worked for a legislative advocacy group (lobbying) for the poor. I was actually dating someone else at the time so my main interest in him was to ask him to help on some of the Church's social justice projects. We started talking some time later after I had written up a summary of a "field" trip I had participated in where we looked at housing and the associated issues for farm workers in the Marysville and Yuba City areas. Housing for the poor was the area he worked in and by this time I was single again. Later that year I helped to organize a workshop that Sr. Helen Prejean (author of *Dead Man Walking*) spoke at. While we were at lunch at the workshop, I realized that he was interested in dating – although somewhat shyly indicated. Our first date was on May 26, 2000 at a Vegetarian Restaurant (now closed). We married on July 25, 2009.

15. My favorite thing to do in my spare time is doing more hiking up in the mountains with Mike and our dogs. I used to do a lot of that in the 90s but hadn't done as much lately. I didn't realize how much I missed it. I love the smell of the pine

and the beauty of the lakes up in the Sierra. My other hobbies include jewelry making. A few of us at work meet at lunch on Tuesdays when we can for an hour and make necklaces, bracelets and earrings. It is a great way to make a personalized gift and in some ways difficult since peoples tastes vary quite a bit. I also love to sketch – primarily portraits. My goal is not only to get the likeness of the person but to try and catch their character, that twinkle in the eye or something that comes through the person that can't really be explained. Recently I have tried water color. I had tried some water color paintings in college but really hadn't done much since then other than some paintings in the style of Chinese Brush Painting. I made a lot of mistakes in my first most recent watercolor but I am overall happy with it. I just need to get more practice with the techniques.

16. I admired people who have a good work ethic, are kind and look out for others. They handle adversity well and are not hardened by it. Those are people that I want to grow up and be like. I don't necessarily have a hero that is well known. It is primarily people that I have met or have been fortunate to know during my life that have had a positive influence on me by their behavior.
17. There are too many books and applications to count on my iPad... I am an app addict and have filled my ipad all sorts of books that I have high hopes of reading.
18. Speaking of books, I have lots of favorite ones. They vary from historical, to fiction, to spiritual. One of my favorite books over the last few years was "*The Immortal Life of Henrietta Lacks*" which is non-fiction and looks at a lot of the issues related to using the cancer cells from a poor woman Henrietta Lacks to help in fighting and curing diseases. The book was a combination of biography, history, science, social issues and ethical questions. Fascinating and very well written. I also love a good light mystery. Lately I have been listening to (via audible) Louise Penny and Donna Leon. Mysteries take place in Quebec (where my ancestors were from) and Northern Italy (where I was born).
19. I am on Facebook – but I am not an avid user. I primarily look to see what is going on in other people's lives but don't often share. Perhaps it is because I spend a lot of time on the computer already and would rather share person to person.
20. If I have to pick one thing that I absolutely hate, I suppose it would be dishonesty in order to get ahead. It is something I don't forget easily and I am always distrustful of that person after that occurs. It is curious because I seem to be better with dishonesty if it is done to protect someone else's feelings.

Tara and her Husband Mike on their Honeymoon in Ireland in 2009.



BRYANT GIORGI

The Real Time Action Guy

Min Yu, Senior Engineer WR, DWR

While Bryant Giorgi has attended nearly every DSM2UG meeting the past three years, you may not know the important role he plays in the development and applications of DSM2. You might have even mistaken the tallish, youngish, soft-spokenish guy for a college student. Well, that's Bryant.

Bryant has been an Engineer, Water Resources with the Delta Compliance and Modeling Section, O&M Division of DWR since spring 2009, right after graduating from UC Davis with a BS degree in Civil Engineering. When Bryant first came on board, DSM2 was transitioning from Version 6 to Version 8. Even though Delta Modeling Section provided updated preprocessing scripts for simulating historical conditions using the newer version, many modifications needed to be made for real-time forecasting applications. Bryant soon proved himself to be a quick learner, taking on the role of updating short-term forecasting schematic and the input files while still getting familiar with DSM2. Since then, Bryant has been a key player in providing State Water Project operators the 21-day forecasted water quality data at the exports and other compliance locations in the south Delta. His other responsibilities include compiling monthly gates and barriers operating files and disseminating that information to the agency folks as well as the public. When I asked Bryant what he sees himself doing five years from now, he simply responded that he truly loves his current job and has very much enjoyed working with his peers in the office. He is very happy where he is and tweaking the tools for problem solving under different operating scenarios is reward enough.

On a personal note, Bryant has been super busy the last few months. He not only purchased a home in the South Land Park area, but also married his high school sweetheart Erica in April. Erica is also a DWR employee, currently working in Fresno as an Environmental Scientist. Besides maintaining a healthy long distance relationship with his new bride, Bryant enjoys playing 'Skyrim', an action role-playing open world video game on PC. As quiet as Bryant seems to be, he in fact is very conversational and enjoys traveling around the globe. Both Bryant and Erica are certified scuba divers, and they have explored some of the world's best diving destinations including New Zealand, Sydney, Fiji, Cayman Island, Costa Rica, and Big Island in Hawaii. So, next time when you see Bryant, besides congratulating the newlywed, you might want to ask him what his avatar has been up to on Skyrim.



Swimming with a Potato Cod at the Great Barrier Reef.



Bryant and Erica next to flowing lava on the Big Island of Hawaii.

AFTER 2 YEARS, I FINALLY CORNERED MIN YU FOR AN INTERVIEW, AND HERE'S WHAT I LEARNED...

Marianne Guerin, Associate, RMA

Yes, it did take two years, but Min Yu finally agreed to let me interview her (after I enlisted Tara for a bit of additional administrative pressure). After all, we've learned about many DSM2UG folks and Delta Modeling Section staff through Min's interviews in the Newsletters, so it was about time we learned more about Min.

My first couple of questions produced a big surprise – I didn't know that Min was born in China! As you might guess, that surprise speaks volumes on Min's prowess in learning a new language. Min says she has had much-appreciated help in her English from other DMS staff (who I'm certain appreciate working with such a high-achieving, diligent student).

Here are some of the other details I learned about Min...

Q: What is your family background?

A: Many of you may already know that Min Yu was born in Shanghai, the largest city in China, and that she has one sibling – a sister. Min is a self-professed “city girl”.

Q: When did you move to the US?

A: Min moved to the States when she was 21 – although she had started learning a bit of English in grade school, she barely spoke English on arrival.



The Louvre, Paris, August 2004.

Q: How did you become so proficient in English?

A: Watching TV helped a lot, and Min would watch shows that were captioned for the hearing impaired. Min also read relaxation literature, for example, books by Danielle Steele, legal thrillers by authors such as John Grisham, and more recently biographies of notable people – the latest being the bio of Steve Jobs. And, Min actively works at embracing her adopted culture – clearly with great success.

Q: Which Chinese language varieties do you speak?

A: Mandarin and a local dialect (“Shanghainese”).

Q: How did you decide to study Engineering and where did you go to school?

A: Min's father was influential in encouraging her to study Mechanical Engineering. In China, she studied at Jiao Tong University. The WIKI for Jiao Tong U. says “It is renowned as one of the oldest and most prestigious and selective universities in China.” Wow!

When Min came to the US she was sponsored by an uncle and attended Sacramento State University where she continued in ME. Luckily for the DSM2UG, Min was later convinced by Dr. Ralph Hwang to study water resources in Civil Engineering at the Master's level.

Q: What Engineering jobs have you held in the US?

A: Min landed a job in DWR as a student when she was 23 – this means she’s been working at DWR for over 20 years! Min works part-time at present, though you’d never guess it as she is always very prompt in answering email.

Q: Tell me about your family life now.

A: Min married her husband, who’s also an Environmental Engineer and coincidentally was also born in Shanghai, when she was 25. For their 10th Wedding Anniversary, they went to Paris (how romantic!), and they hope to return to Europe for their 20th.

Min has one teenage daughter, and her Mother moved to the US and now lives with Min and family.

Min and her husband have a beautiful house in Folsom (this is actually a tidbit supplied by Tara, not by Min).

Min said parenthood has definitely expanded her horizons as a person.

Q: What sorts of things do you do for fun?

A: Min believes in “dressing for success” and looking professional. However, although she’s always fashionable, she’s a bargain hunter at heart – a win-win situation matching her shopping hobby with her career.

Min loves gadgets – she’s an early adopter for electronics.

Min likes taking the role of match-maker – AND, she has some success stories. Min believes in romance.

As we can tell through her success in publishing the DSM2UG newsletter and leading the DSM2 User’s Group, Min is a bit of a perfectionist and gets a lot of satisfaction from getting things done just right.

Min is really thankful she works in such a supportive work environment in the Delta Modeling Section, and I’m really thankful she works in DWR.



CHANDRA CHILMAKURI

An Accidental Yet Exceptional Hydrodynamics Engineer

Min Yu, Senior Engineer WR, DWR

Within the field of modeling of California water resources, Chandra Chilmakuri truly exemplifies professionalism; he's intelligent, conscientious, possesses expertise in Delta hydrodynamics and water quality, and is a pleasant persona. He's also one of the most hardworking engineers I have met and always produces high level work.

Chandra came from Hyderabad, the 6th largest city in India. His given name is actually 'Chandrasekhar', which means 'a guy wearing moon on his crown' in his native language. He graduated with a B. Tech. (Bachelor of Technology) degree in Civil Engineering from JNTU, Hyderabad in 2000 before coming to the States for post-graduate degrees at the University of New Orleans (UNO). His post-graduate studies had a bumpy start. Upon arriving in the U.S., Chandra learned that the professor, who he was supposed to work with on "Air Quality Modeling", was unable to fund his graduate studies. As a result, he was reassigned to another professor who happened to specialize in hydraulics. And so began his unexpected journey in water resources engineering.

Just when hurricane Katrina was clobbering New Orleans at the end of 2005, Chandra was finishing his PhD program and planning to continue with his postdoctoral work at the university. But then once again fate interceded to redirect his career path. Chandra learned that his wife was expecting their first child and finding a full-time job suddenly became top priority. By happenstance, Kyle Winslow and Rob Tull at CH2M HILL in Sacramento were looking for an engineer specializing in hydrodynamics. Chandra's intern supervisor from his previous summer job at the CH2M's New Orleans branch office made the





contact. And the rest, as they say, is history. Chandra and his family relocated to Sacramento at the beginning of 2006 and he has been working for CH2M HILL ever since.

In the past seven years, Chandra has been one of the most indispensable modelers in the DSM2 community, using DSM2 while conducting studies on numerous vital projects. For example, in his first year at CH2M HILL he was a key player for the Common Assumption project, working with DWR's technical team to expand modeling studies of various project alternatives from 16 to 82 years. In addition to being a major player on the Bay Delta Conservation Plan (BDCP) modeling team, Chandra and his colleagues at CH2M HILL remarkably recalibrated DSM2 to incorporate Liberty Island within a very tight three month deadline. Chandra has been continuing to work on various modeling tasks for BDCP, and has been involved in studying Franks Tract (see Page 14) and simulating DSM2-PTM in support of Delta Smelt life cycle model development. Since 2010, Chandra has also been involved in performing CALSIM II studies in order to better understand the complex California's water systems.

Despite his extensive achievements at work, Chandra has still been able to experience a blissful family life. He met his wife Sirisha (a name of a flower in their native language) at UNO and she is also an Engineer at CH2M HILL. They have two boys, ages seven and four, and live in the Natomas area of Sacramento. They enjoy their neighborhood very much and family outings are an important part of their lives. So, in the end, nothing is really accidental about Chandra's decisions except maybe that his favorite food is surprising. A reasonable person would expect him to favor the cuisine of his youth, but he has developed a fondness for Chinese food, particularly fried rice. You will have to ask Chandra what's up with that.

► ASK A MODELER

IF YOU HAVE THE QUESTIONS, WE HAVE THE ANSWERS!

Q: Where can I find the latest gates files?

A: Like many other DSM2 resources, the latest gates information can be found on the DSM2 User Group Portal. In the Portal Library (<https://dsm2ug.water.ca.gov/library>) there is a folder named “Gates.” In that folder there are copies of the most recent gates text file, the most recent gates DSS file, and the last version of the Version 6 text file.

Answer provided by Bryant Giorgi, Engineer WR, DWR

Q: What is VisTA and where can I get the latest version?

A: VisTA is a time series graphing tool with scripting that is used for reading, modifying and writing to HEC-DSS format. It predates HEC-DSSVue and so has substantial overlap with it. It is heavily used in DSM2 for scripting for pre-processing input and post-processing of output.

A VisTA version is packaged with DSM2 releases. However there are ongoing improvements and fixes that are available by downloading the standalone version on VisTA from here (<https://code.google.com/p/dsm2-vista/downloads/list>). Please use with caution as these versions have not been tested against all the scripts in current use and may cause differences.

Answer provided by Nicky Sandhu, Senior Engineer WR, DWR

Q: What is the latest input data available for DSM2 historical simulations?

A: The input data for DSM2 historical simulations has been updated to March 2013. It will be available on DSM2 User Group Portal (<https://dsm2ug.water.ca.gov/library>) after all QA/QC. For now, you may download the past data from the Portal. Please let us know if any changes are needed.

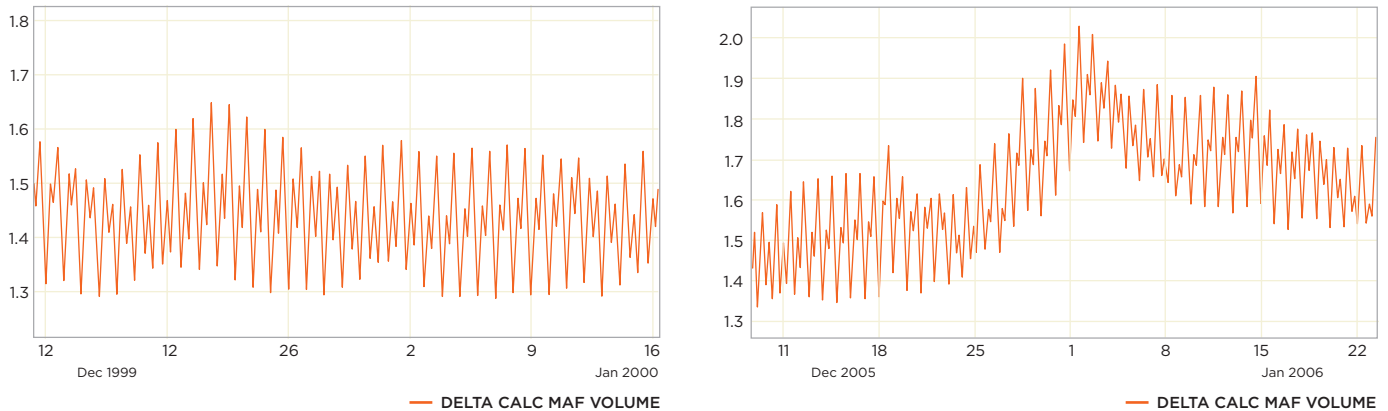
Answer provided by Lan Liang, Engineer WR, DWR



Q: What is the simulated Delta water volume from a DSM2 historical run?

A: DSM2 calculates water levels and flows in the Delta. The tidefile output from DSM2 has volume information about every channel and reservoir at 30 minute intervals. This was aggregated over all channels and reservoirs and labeled as Delta Volume. This volume was then plotted for two periods, one with a low volume and one with a high volume.

Answer provided by Nicky Sandhu, Senior Engineer WR, DWR



Q: How do you specify which constituents to be simulated in the QUAL inputs?

A: When I was a newbie to DSM2, I wondered how can I specify the water quality constituents that I would like QUAL to simulate. For newbies out there, the way QUAL knows about which constituents it is being asked to simulate is based on the outputs requested. For example if you would like to simulate EC and DOC, then you have to add at least one output for each water quality constituent in the QUAL input files.

Answer provided by Chandra Chilmakuri, Project Engineer, CH2M HILL

Q: How can I obtain a copy of CALSIM and DSM2 model input/output for the various BDCP alternatives?

A: You need to send an E-mail to Arnold Sanchez (sanchez@water.ca.gov) AND Brian Heiland (heiland@water.ca.gov) and request the information. Because the file sizes are VERY LARGE, they will instruct you to send a portable hard-drive with enough capacity (500 GB is adequate). Depending on the staff workload, the process may take 5 to 7 business days.

Answer provided by Parviz Nader-Tehrani, Supervising Engineer WR, DWR

If you have any questions or comments regarding this issue of the Newsletter, please contact the facilitator of the DSM2 User Group:

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This newsletter can be accessed at the DSM2 User Group website:

<http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/dsm2usersgroup.cfm>

